Full wwPDB X-ray Structure Validation Report (i)

Oct 20, 2025 – 06:12 PM JST

PDB ID	:	9KAJ / pdb_00009kaj
Title	:	Crystal Structure of Chalcone Syntase from Physcomitrella patens complexed with Coenzyme A
Authors	:	Imaizumi, R.; Waki, T.; Yasuda, A.; Yanai, T.; Takeshita, K.; Sakai, N.; Yamamoto, M.; Nakayama, T.; Yamashita, S.
Deposited on	:	2024-10-28
Resolution	:	2.64 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (i)) were used in the production of this report:

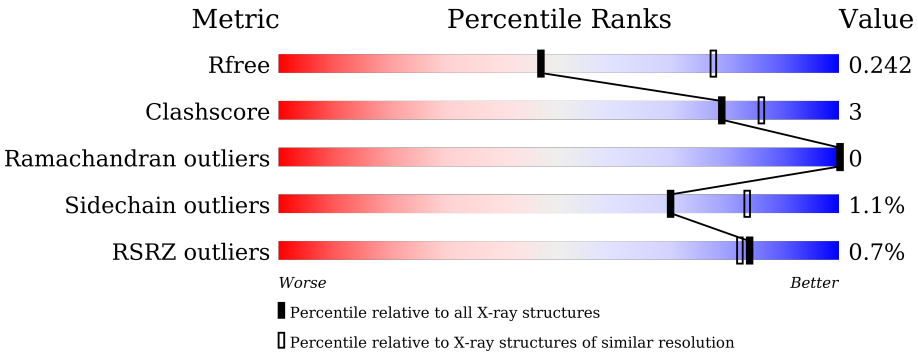
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.46

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.64 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	1851 (2.66-2.62)
Clashscore	180529	1953 (2.66-2.62)
Ramachandran outliers	177936	1929 (2.66-2.62)
Sidechain outliers	177891	1929 (2.66-2.62)
RSRZ outliers	164620	1850 (2.66-2.62)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	413	% 84% 9% 7%
1	B	413	87% 5% 7%
1	C	413	85% 7% • 7%
1	D	413	89% • 7%
1	E	413	85% 7% 7%

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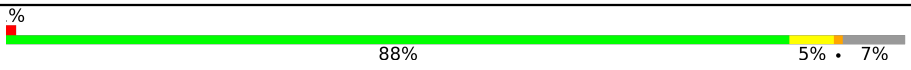
Mol	Chain	Length	Quality of chain
1	F	413	

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 18034 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Chalcone synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	383	Total	C	N	O	S	0	2	0
			2924	1865	507	537	15			
1	B	383	Total	C	N	O	S	0	0	0
			2903	1850	503	535	15			
1	C	383	Total	C	N	O	S	0	0	0
			2903	1850	503	535	15			
1	D	383	Total	C	N	O	S	0	4	0
			2937	1869	511	541	16			
1	E	383	Total	C	N	O	S	0	0	0
			2903	1850	503	535	15			
1	F	386	Total	C	N	O	S	0	1	0
			2933	1870	509	539	15			

There are 96 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-15	MET	-	initiating methionine	UNP Q2VAZ3
A	-14	ASN	-	expression tag	UNP Q2VAZ3
A	-13	HIS	-	expression tag	UNP Q2VAZ3
A	-12	LYS	-	expression tag	UNP Q2VAZ3
A	-11	VAL	-	expression tag	UNP Q2VAZ3
A	-10	HIS	-	expression tag	UNP Q2VAZ3
A	-9	HIS	-	expression tag	UNP Q2VAZ3
A	-8	HIS	-	expression tag	UNP Q2VAZ3
A	-7	HIS	-	expression tag	UNP Q2VAZ3
A	-6	HIS	-	expression tag	UNP Q2VAZ3
A	-5	HIS	-	expression tag	UNP Q2VAZ3
A	-4	ILE	-	expression tag	UNP Q2VAZ3
A	-3	GLU	-	expression tag	UNP Q2VAZ3
A	-2	GLY	-	expression tag	UNP Q2VAZ3
A	-1	ARG	-	expression tag	UNP Q2VAZ3
A	0	HIS	-	expression tag	UNP Q2VAZ3
B	-15	MET	-	initiating methionine	UNP Q2VAZ3

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-14	ASN	-	expression tag	UNP Q2VAZ3
B	-13	HIS	-	expression tag	UNP Q2VAZ3
B	-12	LYS	-	expression tag	UNP Q2VAZ3
B	-11	VAL	-	expression tag	UNP Q2VAZ3
B	-10	HIS	-	expression tag	UNP Q2VAZ3
B	-9	HIS	-	expression tag	UNP Q2VAZ3
B	-8	HIS	-	expression tag	UNP Q2VAZ3
B	-7	HIS	-	expression tag	UNP Q2VAZ3
B	-6	HIS	-	expression tag	UNP Q2VAZ3
B	-5	HIS	-	expression tag	UNP Q2VAZ3
B	-4	ILE	-	expression tag	UNP Q2VAZ3
B	-3	GLU	-	expression tag	UNP Q2VAZ3
B	-2	GLY	-	expression tag	UNP Q2VAZ3
B	-1	ARG	-	expression tag	UNP Q2VAZ3
B	0	HIS	-	expression tag	UNP Q2VAZ3
C	-15	MET	-	initiating methionine	UNP Q2VAZ3
C	-14	ASN	-	expression tag	UNP Q2VAZ3
C	-13	HIS	-	expression tag	UNP Q2VAZ3
C	-12	LYS	-	expression tag	UNP Q2VAZ3
C	-11	VAL	-	expression tag	UNP Q2VAZ3
C	-10	HIS	-	expression tag	UNP Q2VAZ3
C	-9	HIS	-	expression tag	UNP Q2VAZ3
C	-8	HIS	-	expression tag	UNP Q2VAZ3
C	-7	HIS	-	expression tag	UNP Q2VAZ3
C	-6	HIS	-	expression tag	UNP Q2VAZ3
C	-5	HIS	-	expression tag	UNP Q2VAZ3
C	-4	ILE	-	expression tag	UNP Q2VAZ3
C	-3	GLU	-	expression tag	UNP Q2VAZ3
C	-2	GLY	-	expression tag	UNP Q2VAZ3
C	-1	ARG	-	expression tag	UNP Q2VAZ3
C	0	HIS	-	expression tag	UNP Q2VAZ3
D	-15	MET	-	initiating methionine	UNP Q2VAZ3
D	-14	ASN	-	expression tag	UNP Q2VAZ3
D	-13	HIS	-	expression tag	UNP Q2VAZ3
D	-12	LYS	-	expression tag	UNP Q2VAZ3
D	-11	VAL	-	expression tag	UNP Q2VAZ3
D	-10	HIS	-	expression tag	UNP Q2VAZ3
D	-9	HIS	-	expression tag	UNP Q2VAZ3
D	-8	HIS	-	expression tag	UNP Q2VAZ3
D	-7	HIS	-	expression tag	UNP Q2VAZ3
D	-6	HIS	-	expression tag	UNP Q2VAZ3
D	-5	HIS	-	expression tag	UNP Q2VAZ3

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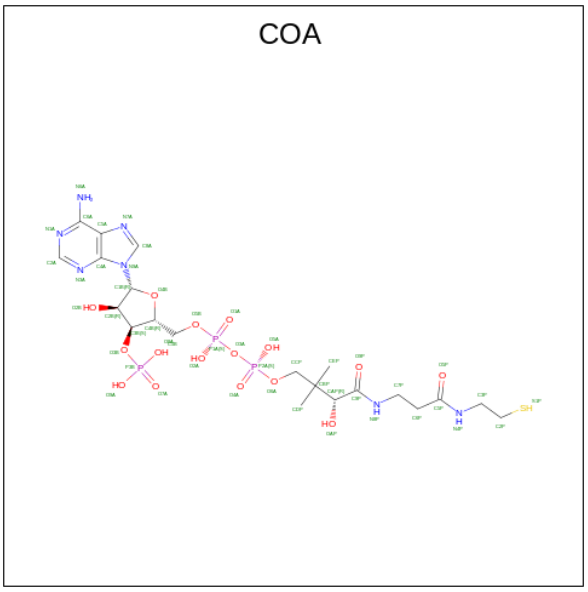
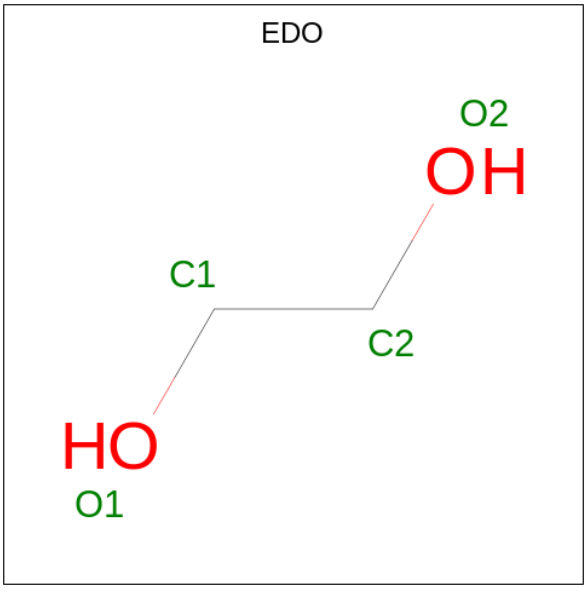
Chain	Residue	Modelled	Actual	Comment	Reference
D	-4	ILE	-	expression tag	UNP Q2VAZ3
D	-3	GLU	-	expression tag	UNP Q2VAZ3
D	-2	GLY	-	expression tag	UNP Q2VAZ3
D	-1	ARG	-	expression tag	UNP Q2VAZ3
D	0	HIS	-	expression tag	UNP Q2VAZ3
E	-15	MET	-	initiating methionine	UNP Q2VAZ3
E	-14	ASN	-	expression tag	UNP Q2VAZ3
E	-13	HIS	-	expression tag	UNP Q2VAZ3
E	-12	LYS	-	expression tag	UNP Q2VAZ3
E	-11	VAL	-	expression tag	UNP Q2VAZ3
E	-10	HIS	-	expression tag	UNP Q2VAZ3
E	-9	HIS	-	expression tag	UNP Q2VAZ3
E	-8	HIS	-	expression tag	UNP Q2VAZ3
E	-7	HIS	-	expression tag	UNP Q2VAZ3
E	-6	HIS	-	expression tag	UNP Q2VAZ3
E	-5	HIS	-	expression tag	UNP Q2VAZ3
E	-4	ILE	-	expression tag	UNP Q2VAZ3
E	-3	GLU	-	expression tag	UNP Q2VAZ3
E	-2	GLY	-	expression tag	UNP Q2VAZ3
E	-1	ARG	-	expression tag	UNP Q2VAZ3
E	0	HIS	-	expression tag	UNP Q2VAZ3
F	-15	MET	-	initiating methionine	UNP Q2VAZ3
F	-14	ASN	-	expression tag	UNP Q2VAZ3
F	-13	HIS	-	expression tag	UNP Q2VAZ3
F	-12	LYS	-	expression tag	UNP Q2VAZ3
F	-11	VAL	-	expression tag	UNP Q2VAZ3
F	-10	HIS	-	expression tag	UNP Q2VAZ3
F	-9	HIS	-	expression tag	UNP Q2VAZ3
F	-8	HIS	-	expression tag	UNP Q2VAZ3
F	-7	HIS	-	expression tag	UNP Q2VAZ3
F	-6	HIS	-	expression tag	UNP Q2VAZ3
F	-5	HIS	-	expression tag	UNP Q2VAZ3
F	-4	ILE	-	expression tag	UNP Q2VAZ3
F	-3	GLU	-	expression tag	UNP Q2VAZ3
F	-2	GLY	-	expression tag	UNP Q2VAZ3
F	-1	ARG	-	expression tag	UNP Q2VAZ3
F	0	HIS	-	expression tag	UNP Q2VAZ3

- Molecule 2 is COENZYME A (CCD ID: COA) (formula: $C_{21}H_{36}N_7O_{16}P_3S$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	S	0	0
			48	21	7	16	3	1		
2	B	1	Total	C	N	O	P	S	0	1
			96	42	14	32	6	2		
2	C	1	Total	C	N	O	P	S	0	0
			48	21	7	16	3	1		

- Molecule 3 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			4	2	2		

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	D	1	Total C O 4 2 2	0	0
3	D	1	Total C O 4 2 2	0	0
3	F	1	Total C O 4 2 2	0	0

- Molecule 4 is water.

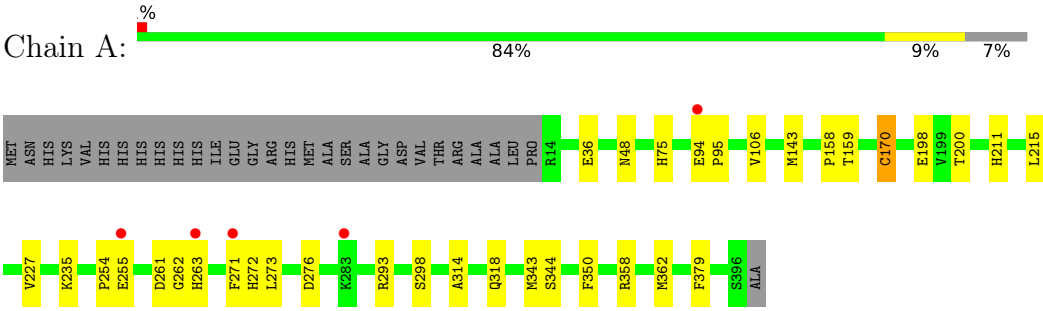
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	69	Total O 69 69	0	0
4	B	50	Total O 50 50	0	0
4	C	56	Total O 56 56	0	0
4	D	47	Total O 47 47	0	0
4	E	47	Total O 47 47	0	0
4	F	54	Total O 54 54	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

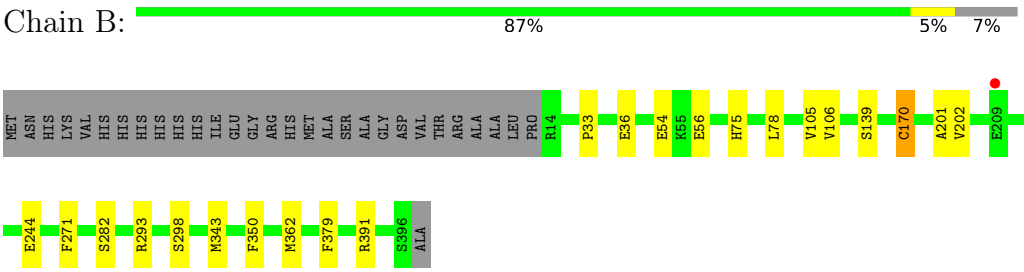
• Molecule 1: Chalcone synthase

Chain A:



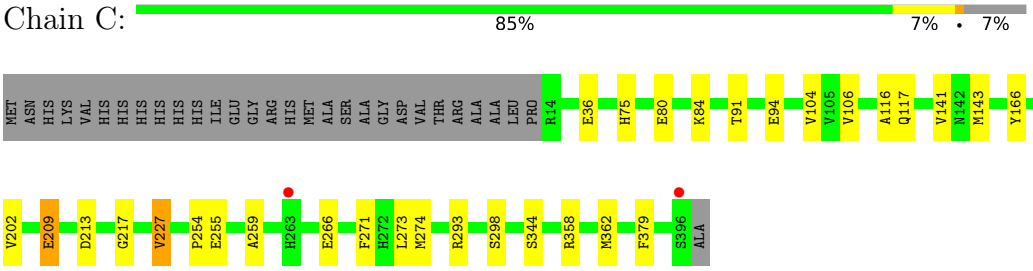
• Molecule 1: Chalcone synthase

Chain B:



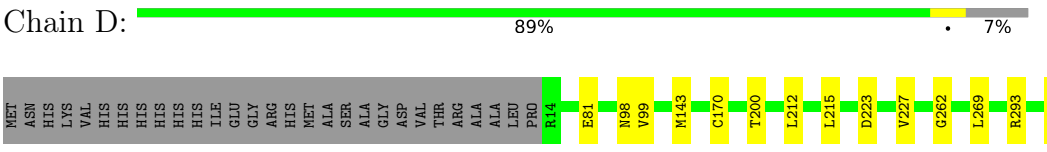
• Molecule 1: Chalcone synthase

Chain C:



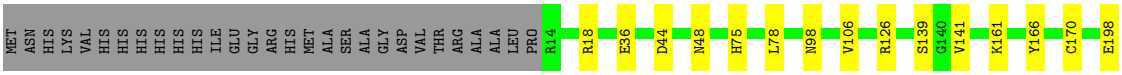
• Molecule 1: Chalcone synthase

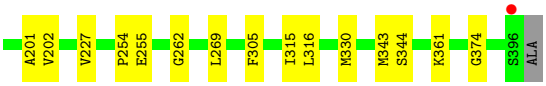
Chain D:



• Molecule 1: Chalcone synthase

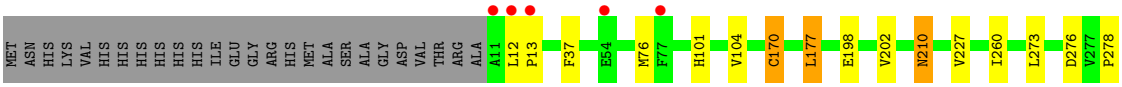
Chain E:

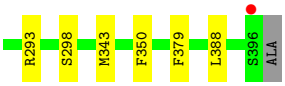




• Molecule 1: Chalcone synthase

Chain F:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α, β, γ	190.17Å 198.99Å 68.43Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.13 – 2.64 48.13 – 2.64	Depositor EDS
% Data completeness (in resolution range)	99.0 (48.13-2.64) 99.0 (48.13-2.64)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.56 (at 2.65Å)	Xtriage
Refinement program	PHENIX 1.21.2_5419, REFMAC 5.8.0430	Depositor
R, R_{free}	0.195 , 0.241 0.196 , 0.242	Depositor DCC
R_{free} test set	3828 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å^2)	35.4	Xtriage
Anisotropy	0.270	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 50.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.006 for k,h,-l	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	18034	wwPDB-VP
Average B, all atoms (Å^2)	34.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.51% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: COA, EDO, CSD

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\#\|Z\| > 5$	RMSZ	$\#\|Z\| > 5$
1	A	0.44	0/2981	0.64	0/4032
1	B	0.43	0/2958	0.65	1/4001 (0.0%)
1	C	0.41	0/2958	0.63	0/4001
1	D	0.42	0/2993	0.61	0/4048
1	E	0.41	0/2958	0.62	0/4001
1	F	0.41	0/2990	0.64	0/4046
All	All	0.42	0/17838	0.63	1/24129 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	213	ASP	CA-CB-CG	5.33	117.93	112.60

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2924	0	2946	23	0
1	B	2903	0	2932	15	0
1	C	2903	0	2932	24	0
1	D	2937	0	2956	13	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	E	2903	0	2932	15	0
1	F	2933	0	2961	12	0
2	A	48	0	32	1	0
2	B	96	0	64	0	0
2	C	48	0	32	0	0
3	A	4	0	6	0	0
3	D	8	0	12	0	0
3	F	4	0	6	0	0
4	A	69	0	0	8	0
4	B	50	0	0	2	0
4	C	56	0	0	0	0
4	D	47	0	0	0	0
4	E	47	0	0	2	0
4	F	54	0	0	0	0
All	All	18034	0	17811	92	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

All (92) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:116:ALA:HA	1:C:227:VAL:HG21	1.69	0.74
1:A:293:ARG:HB3	1:A:298:SER:HA	1.69	0.74
1:A:276:ASP:HB2	4:A:562:HOH:O	1.93	0.69
1:A:158:PRO:HG2	4:A:508:HOH:O	1.94	0.67
1:A:262:GLY:HA3	1:D:143:MET:HE3	1.75	0.67
1:C:104:VAL:HG11	1:C:202:VAL:HG23	1.78	0.65
1:C:259:ALA:HA	1:C:274:MET:HE2	1.79	0.65
1:A:261:ASP:HB2	1:A:272:HIS:HB2	1.79	0.64
1:A:143:MET:HE3	1:D:262:GLY:HA3	1.82	0.61
1:C:143:MET:HE3	1:E:262:GLY:HA3	1.82	0.61
1:C:254:PRO:C	1:C:255:GLU:HG2	2.29	0.58
1:B:54:GLU:HG3	1:C:117:GLN:HE21	1.69	0.58
1:A:94:GLU:CD	1:A:95:PRO:HD2	2.29	0.57
1:B:54:GLU:CG	1:C:117:GLN:HE21	2.17	0.57
1:C:271:PHE:CD1	1:C:273:LEU:HD23	2.42	0.54
1:A:358:ARG:O	1:A:362:MET:HG2	2.08	0.54
1:C:217:GLY:HA3	1:C:271:PHE:CZ	2.43	0.53
1:B:78:LEU:HD11	1:B:201:ALA:HA	1.91	0.53
1:C:170:CSD:HB3	1:C:379:PHE:O	2.09	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:217:GLY:HA3	1:A:271[B]:PHE:CZ	2.45	0.52
1:B:244:GLU:OE1	1:B:391:ARG:HD2	2.10	0.52
1:B:293:ARG:HB3	1:B:298:SER:HA	1.92	0.51
1:A:159:THR:HG23	4:A:508:HOH:O	2.10	0.51
1:D:81:GLU:H	1:D:81:GLU:CD	2.18	0.51
1:D:293:ARG:HB3	1:D:298:SER:HA	1.91	0.51
1:C:293:ARG:HB3	1:C:298:SER:HA	1.93	0.51
1:E:44:ASP:O	1:E:48:ASN:HB2	2.10	0.51
1:B:139:SER:HA	1:B:202:VAL:HG11	1.93	0.50
1:C:91:THR:OG1	1:C:94:GLU:HB2	2.11	0.50
1:F:293:ARG:HB3	1:F:298:SER:HA	1.94	0.50
1:C:143:MET:HE2	1:E:269:LEU:HD11	1.93	0.50
1:E:36:GLU:HG2	1:E:75:HIS:CE1	2.47	0.50
1:C:271:PHE:HD1	1:C:273:LEU:HD23	1.78	0.49
1:C:266:GLU:OE1	1:E:98:ASN:HB2	2.13	0.48
1:F:12:LEU:HD23	1:F:13:PRO:O	2.13	0.48
1:B:293:ARG:HD2	1:B:298:SER:HA	1.95	0.48
4:A:502:HOH:O	1:D:99:VAL:HG13	2.12	0.48
1:C:358:ARG:O	1:C:362:MET:HG2	2.14	0.48
1:D:293:ARG:HD2	1:D:298:SER:HA	1.96	0.48
1:B:56:GLU:HG3	4:B:550:HOH:O	2.13	0.47
1:C:80:GLU:HG2	1:C:84:LYS:HE2	1.96	0.47
1:C:217:GLY:HA3	1:C:271:PHE:HZ	1.79	0.47
1:A:254:PRO:C	1:A:255:GLU:HG2	2.40	0.47
1:F:260:ILE:HG12	1:F:273:LEU:CD1	2.44	0.47
1:E:78:LEU:HD11	1:E:201:ALA:HA	1.98	0.46
1:B:36:GLU:HG2	1:B:75:HIS:CE1	2.51	0.45
1:B:54:GLU:CD	1:C:117:GLN:HE21	2.24	0.45
1:F:177:LEU:HD13	1:F:388:LEU:HD22	1.99	0.45
1:E:198:GLU:HG3	1:E:344:SER:HB3	1.98	0.45
1:A:273:LEU:HD21	2:A:401:COA:H22	1.99	0.45
1:E:126:ARG:HG3	4:E:439:HOH:O	2.17	0.45
1:C:293:ARG:HD2	1:C:298:SER:HA	2.00	0.44
4:A:502:HOH:O	1:D:98[A]:ASN:HB2	2.18	0.44
1:A:314:ALA:O	1:A:318:GLN:HG3	2.17	0.44
1:A:235:LYS:HE3	4:A:566:HOH:O	2.17	0.43
1:E:141:VAL:HA	1:E:166:TYR:CE1	2.53	0.43
1:A:211:HIS:HE1	4:A:549:HOH:O	2.01	0.43
1:B:217:GLY:HA3	1:B:271:PHE:CZ	2.53	0.43
1:D:358:ARG:O	1:D:362:MET:HG2	2.17	0.43
1:D:200:THR:HG23	1:D:223:ASP:OD1	2.19	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:316:LEU:HD22	1:E:330:MET:CE	2.49	0.43
1:F:101[B]:HIS:HA	1:F:104:VAL:HG22	2.01	0.43
1:E:161:LYS:HE2	4:E:409:HOH:O	2.19	0.43
1:B:33:PRO:HB2	4:B:532:HOH:O	2.18	0.42
1:C:141:VAL:HA	1:C:166:TYR:CE1	2.54	0.42
1:C:198:GLU:HG3	1:C:344:SER:HB3	2.01	0.42
1:F:210:ASN:ND2	1:F:210:ASN:C	2.78	0.42
1:E:305:PHE:CE1	1:E:374:GLY:HA3	2.55	0.42
1:E:254:PRO:C	1:E:255:GLU:HG2	2.45	0.42
1:A:215:LEU:HD23	1:A:215:LEU:HA	1.86	0.42
1:D:293:ARG:HD3	1:D:299:PRO:O	2.20	0.42
1:A:271[A]:PHE:HE2	4:A:501:HOH:O	2.03	0.42
1:F:170:CSD:HB3	1:F:379:PHE:O	2.20	0.42
1:C:36:GLU:HG2	1:C:75:HIS:CE1	2.55	0.41
1:A:36:GLU:HG2	1:A:75:HIS:CE1	2.56	0.41
1:A:198:GLU:HG3	1:A:344:SER:HB3	2.02	0.41
1:A:170:CSD:HB3	1:A:379:PHE:O	2.21	0.41
1:B:343:MET:HE1	1:B:350:PHE:CD2	2.56	0.41
1:D:215:LEU:HD23	1:D:215:LEU:HA	1.87	0.41
1:F:104:VAL:HG11	1:F:202:VAL:HG23	2.03	0.41
1:A:200:THR:HG23	1:A:223:ASP:OD1	2.20	0.41
1:E:139:SER:HA	1:E:202:VAL:HG11	2.02	0.41
1:F:343:MET:HE1	1:F:350:PHE:CD2	2.56	0.41
1:A:343:MET:HE1	1:A:350:PHE:CG	2.56	0.40
1:B:362:MET:HB3	1:D:212:LEU:HD11	2.04	0.40
1:E:198:GLU:HG3	1:E:343:MET:O	2.21	0.40
1:F:37:PHE:CE1	1:F:76:MET:HB2	2.56	0.40
1:C:209:GLU:CD	1:C:209:GLU:H	2.30	0.40
1:F:198:GLU:HG3	1:F:343:MET:O	2.22	0.40
1:F:276:ASP:OD1	1:F:278:PRO:HD2	2.22	0.40
1:A:143:MET:HE1	1:D:269:LEU:HD21	2.03	0.40
1:B:170:CSD:HB3	1:B:379:PHE:O	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries

of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	382/413 (92%)	371 (97%)	11 (3%)	0	100	100
1	B	380/413 (92%)	371 (98%)	9 (2%)	0	100	100
1	C	380/413 (92%)	370 (97%)	10 (3%)	0	100	100
1	D	384/413 (93%)	373 (97%)	11 (3%)	0	100	100
1	E	380/413 (92%)	372 (98%)	8 (2%)	0	100	100
1	F	384/413 (93%)	374 (97%)	10 (3%)	0	100	100
All	All	2290/2478 (92%)	2231 (97%)	59 (3%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	307/328 (94%)	302 (98%)	5 (2%)	58	75
1	B	305/328 (93%)	301 (99%)	4 (1%)	65	80
1	C	305/328 (93%)	301 (99%)	4 (1%)	65	80
1	D	309/328 (94%)	308 (100%)	1 (0%)	91	96
1	E	305/328 (93%)	300 (98%)	5 (2%)	58	75
1	F	308/328 (94%)	305 (99%)	3 (1%)	73	85
All	All	1839/1968 (93%)	1817 (99%)	22 (1%)	70	82

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	48	ASN
1	A	106	VAL
1	A	227	VAL

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Mol	Chain	Res	Type
1	A	263[A]	HIS
1	A	263[B]	HIS
1	B	105	VAL
1	B	106	VAL
1	B	213	ASP
1	B	282	SER
1	C	106	VAL
1	C	209	GLU
1	C	213	ASP
1	C	227	VAL
1	D	227	VAL
1	E	18	ARG
1	E	106	VAL
1	E	227	VAL
1	E	315	ILE
1	E	361	LYS
1	F	177	LEU
1	F	210	ASN
1	F	227	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (16) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	48	ASN
1	A	86	ASN
1	A	117	GLN
1	A	167	GLN
1	B	117	GLN
1	C	86	ASN
1	C	117	GLN
1	C	210	ASN
1	C	272	HIS
1	D	16	GLN
1	D	246	HIS
1	E	98	ASN
1	E	331	GLN
1	F	48	ASN
1	F	263	HIS
1	F	272	HIS

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

6 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
1	CSD	E	170	1	3,7,8	0.41	0	1,8,10	8.01	1 (100%)
1	CSD	B	170	1	3,7,8	0.45	0	1,8,10	7.98	1 (100%)
1	CSD	D	170	1	3,7,8	0.40	0	1,8,10	8.34	1 (100%)
1	CSD	F	170	1	3,7,8	0.66	0	1,8,10	7.86	1 (100%)
1	CSD	C	170	1	3,7,8	0.58	0	1,8,10	8.42	1 (100%)
1	CSD	A	170	1	3,7,8	0.57	0	1,8,10	7.07	1 (100%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	CSD	E	170	1	-	1/2/6/8	-
1	CSD	B	170	1	-	1/2/6/8	-
1	CSD	D	170	1	-	0/2/6/8	-
1	CSD	F	170	1	-	0/2/6/8	-
1	CSD	C	170	1	-	0/2/6/8	-
1	CSD	A	170	1	-	1/2/6/8	-

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	170	CSD	OD1-SG-CB	8.42	121.57	105.54

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	170	CSD	OD1-SG-CB	8.34	121.40	105.54
1	E	170	CSD	OD1-SG-CB	8.01	120.78	105.54
1	B	170	CSD	OD1-SG-CB	7.98	120.72	105.54
1	F	170	CSD	OD1-SG-CB	7.86	120.50	105.54
1	A	170	CSD	OD1-SG-CB	7.07	118.99	105.54

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	170	CSD	CA-CB-SG-OD1
1	E	170	CSD	CA-CB-SG-OD1
1	B	170	CSD	N-CA-CB-SG

There are no ring outliers.

4 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	B	170	CSD	1	0
1	F	170	CSD	1	0
1	C	170	CSD	1	0
1	A	170	CSD	1	0

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

8 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
2	COA	B	401[B]	-	41,50,50	0.58	0	52,75,75	0.68	1 (1%)
2	COA	B	401[A]	-	41,50,50	0.58	0	52,75,75	0.68	1 (1%)
3	EDO	F	401	-	3,3,3	0.27	0	2,2,2	0.23	0
3	EDO	D	402	-	3,3,3	0.36	0	2,2,2	0.04	0
2	COA	A	401	-	41,50,50	0.60	0	52,75,75	0.70	1 (1%)
3	EDO	D	401	-	3,3,3	0.36	0	2,2,2	0.14	0
2	COA	C	401	-	41,50,50	0.60	0	52,75,75	0.75	2 (3%)
3	EDO	A	402	-	3,3,3	0.31	0	2,2,2	0.11	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	COA	B	401[B]	-	-	22/44/64/64	0/3/3/3
2	COA	B	401[A]	-	-	20/44/64/64	0/3/3/3
3	EDO	F	401	-	-	1/1/1/1	-
3	EDO	D	402	-	-	1/1/1/1	-
2	COA	A	401	-	-	10/44/64/64	0/3/3/3
3	EDO	D	401	-	-	1/1/1/1	-
2	COA	C	401	-	-	16/44/64/64	0/3/3/3
3	EDO	A	402	-	-	0/1/1/1	-

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	401	COA	C5A-C6A-N6A	2.43	124.05	120.35
2	B	401[B]	COA	C5A-C6A-N6A	2.36	123.93	120.35
2	B	401[A]	COA	C5A-C6A-N6A	2.35	123.92	120.35
2	A	401	COA	C5A-C6A-N6A	2.33	123.90	120.35
2	C	401	COA	C2B-C3B-C4B	-2.14	99.43	103.22

There are no chirality outliers.

All (71) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	401	COA	C5B-O5B-P1A-O1A

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Mol	Chain	Res	Type	Atoms
2	A	401	COA	C6P-C5P-N4P-C3P
2	A	401	COA	O5P-C5P-N4P-C3P
2	A	401	COA	S1P-C2P-C3P-N4P
2	B	401[A]	COA	CCP-O6A-P2A-O3A
2	B	401[A]	COA	CCP-O6A-P2A-O5A
2	B	401[A]	COA	C9P-CAP-CBP-CCP
2	B	401[A]	COA	C9P-CAP-CBP-CEP
2	B	401[A]	COA	N8P-C9P-CAP-OAP
2	B	401[A]	COA	C5P-C6P-C7P-N8P
2	B	401[A]	COA	C6P-C5P-N4P-C3P
2	B	401[A]	COA	O5P-C5P-N4P-C3P
2	B	401[B]	COA	CCP-O6A-P2A-O4A
2	B	401[B]	COA	CCP-O6A-P2A-O5A
2	B	401[B]	COA	C9P-CAP-CBP-CCP
2	B	401[B]	COA	C9P-CAP-CBP-CDP
2	B	401[B]	COA	C9P-CAP-CBP-CEP
2	B	401[B]	COA	N8P-C9P-CAP-OAP
2	B	401[B]	COA	C5P-C6P-C7P-N8P
2	B	401[B]	COA	C6P-C5P-N4P-C3P
2	B	401[B]	COA	O5P-C5P-N4P-C3P
2	C	401	COA	C5B-O5B-P1A-O2A
2	C	401	COA	CCP-O6A-P2A-O5A
2	C	401	COA	CAP-C9P-N8P-C7P
2	C	401	COA	C5P-C6P-C7P-N8P
2	C	401	COA	C6P-C5P-N4P-C3P
2	C	401	COA	O5P-C5P-N4P-C3P
3	D	401	EDO	O1-C1-C2-O2
2	B	401[A]	COA	O4B-C4B-C5B-O5B
2	B	401[B]	COA	O4B-C4B-C5B-O5B
3	D	402	EDO	O1-C1-C2-O2
3	F	401	EDO	O1-C1-C2-O2
2	B	401[A]	COA	O9P-C9P-CAP-OAP
2	B	401[B]	COA	O9P-C9P-CAP-OAP
2	B	401[A]	COA	OAP-CAP-CBP-CDP
2	B	401[A]	COA	OAP-CAP-CBP-CEP
2	B	401[B]	COA	OAP-CAP-CBP-CDP
2	B	401[B]	COA	OAP-CAP-CBP-CEP
2	B	401[A]	COA	P2A-O3A-P1A-O1A
2	B	401[B]	COA	P2A-O3A-P1A-O1A
2	B	401[A]	COA	P1A-O3A-P2A-O6A
2	B	401[B]	COA	P1A-O3A-P2A-O6A
2	C	401	COA	P1A-O3A-P2A-O6A

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Mol	Chain	Res	Type	Atoms
2	A	401	COA	C5P-C6P-C7P-N8P
2	A	401	COA	C5B-O5B-P1A-O3A
2	B	401[A]	COA	C3B-O3B-P3B-O8A
2	B	401[B]	COA	C3B-O3B-P3B-O8A
2	B	401[B]	COA	CCP-O6A-P2A-O3A
2	C	401	COA	C5B-O5B-P1A-O3A
2	C	401	COA	CCP-O6A-P2A-O3A
2	B	401[A]	COA	CCP-O6A-P2A-O4A
2	C	401	COA	CCP-O6A-P2A-O4A
2	B	401[A]	COA	C3B-C4B-C5B-O5B
2	B	401[B]	COA	C3B-C4B-C5B-O5B
2	B	401[A]	COA	OAP-CAP-CBP-CCP
2	B	401[B]	COA	OAP-CAP-CBP-CCP
2	C	401	COA	O9P-C9P-N8P-C7P
2	A	401	COA	CEP-CBP-CCP-O6A
2	B	401[A]	COA	P2A-O3A-P1A-O2A
2	B	401[B]	COA	P2A-O3A-P1A-O2A
2	B	401[B]	COA	O5P-C5P-C6P-C7P
2	B	401[B]	COA	N4P-C5P-C6P-C7P
2	C	401	COA	O4B-C4B-C5B-O5B
2	A	401	COA	CDP-CBP-CCP-O6A
2	C	401	COA	P2A-O3A-P1A-O1A
2	B	401[A]	COA	C9P-CAP-CBP-CDP
2	C	401	COA	P2A-O3A-P1A-O2A
2	A	401	COA	CBP-CCP-O6A-P2A
2	A	401	COA	C5B-O5B-P1A-O2A
2	C	401	COA	C5B-O5B-P1A-O1A
2	C	401	COA	CDP-CBP-CCP-O6A

There are no ring outliers.

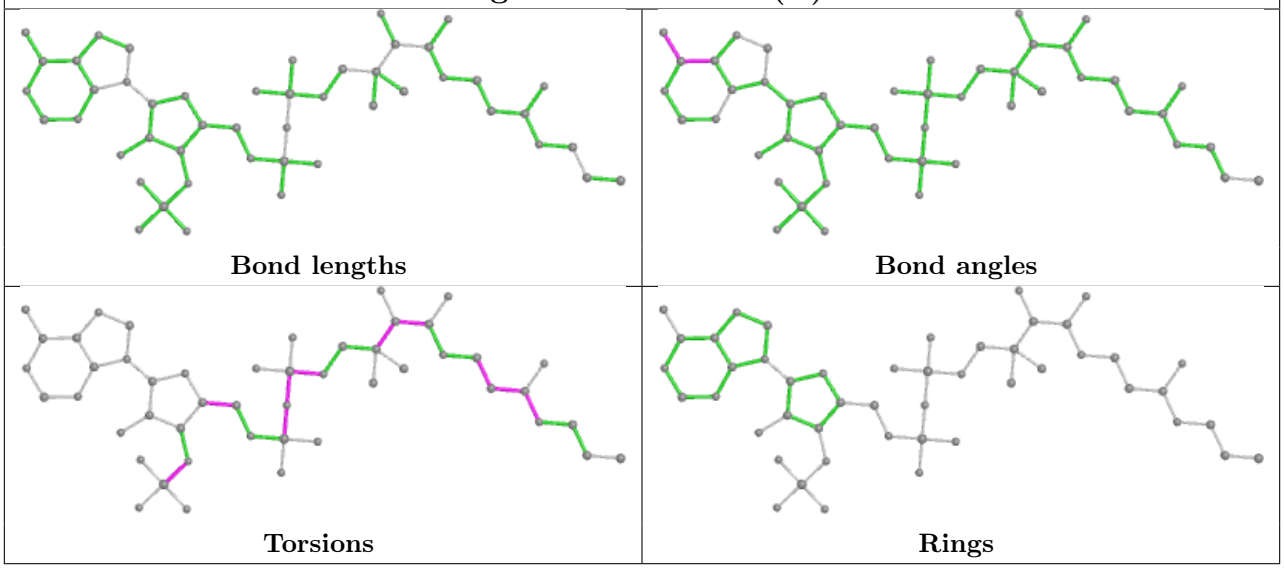
1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	401	COA	1	0

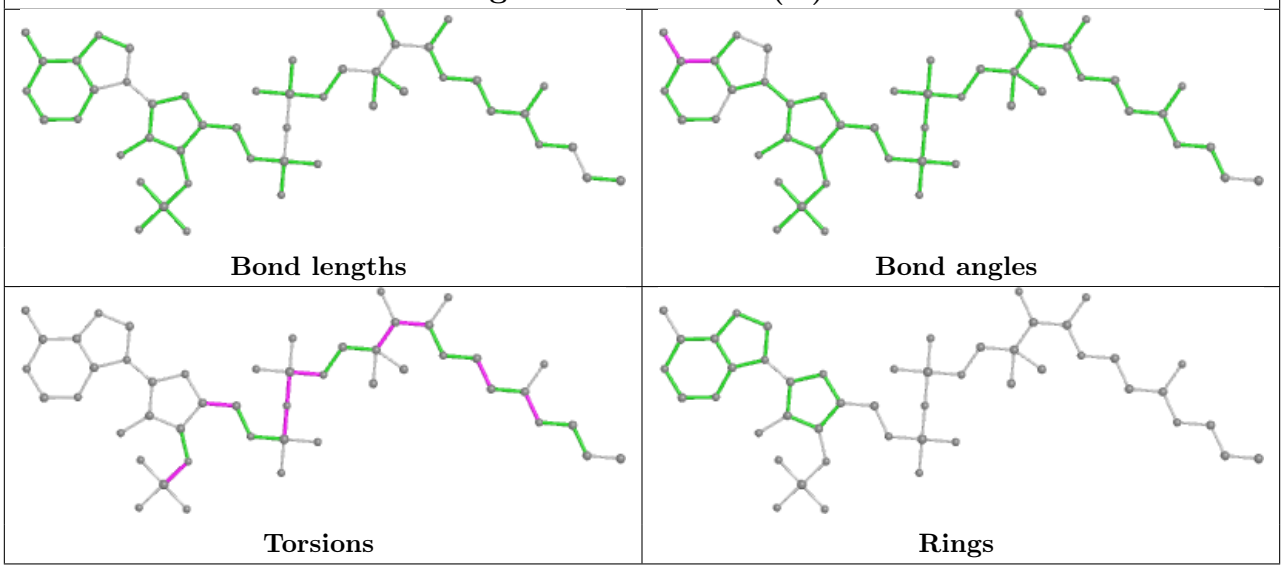
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring

in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

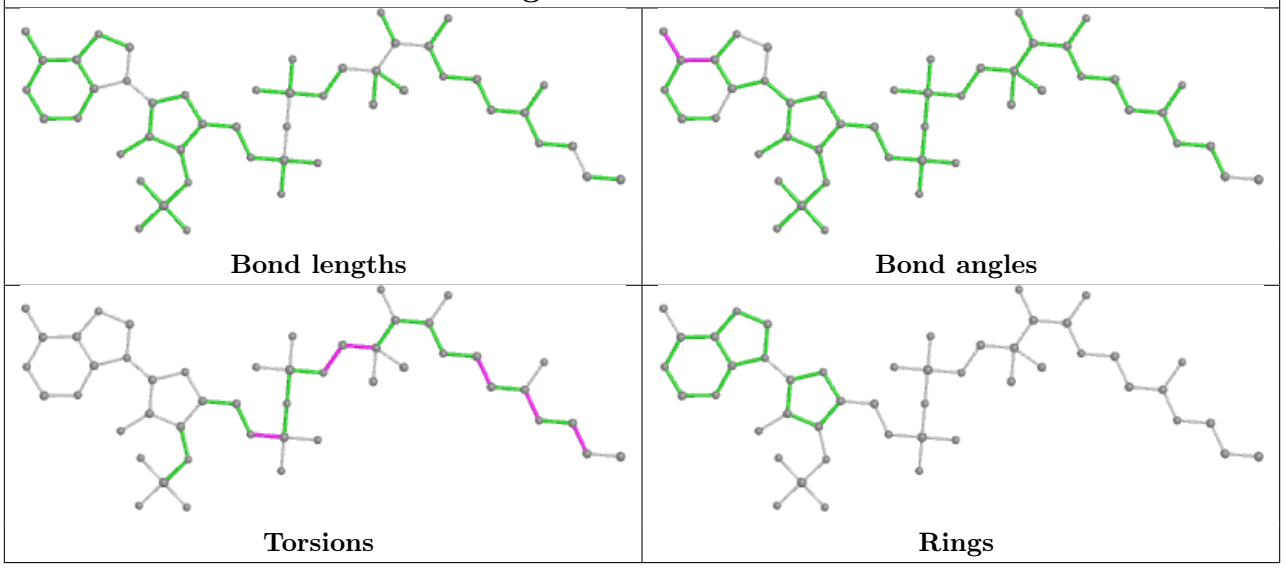
Ligand COA B 401 (B)



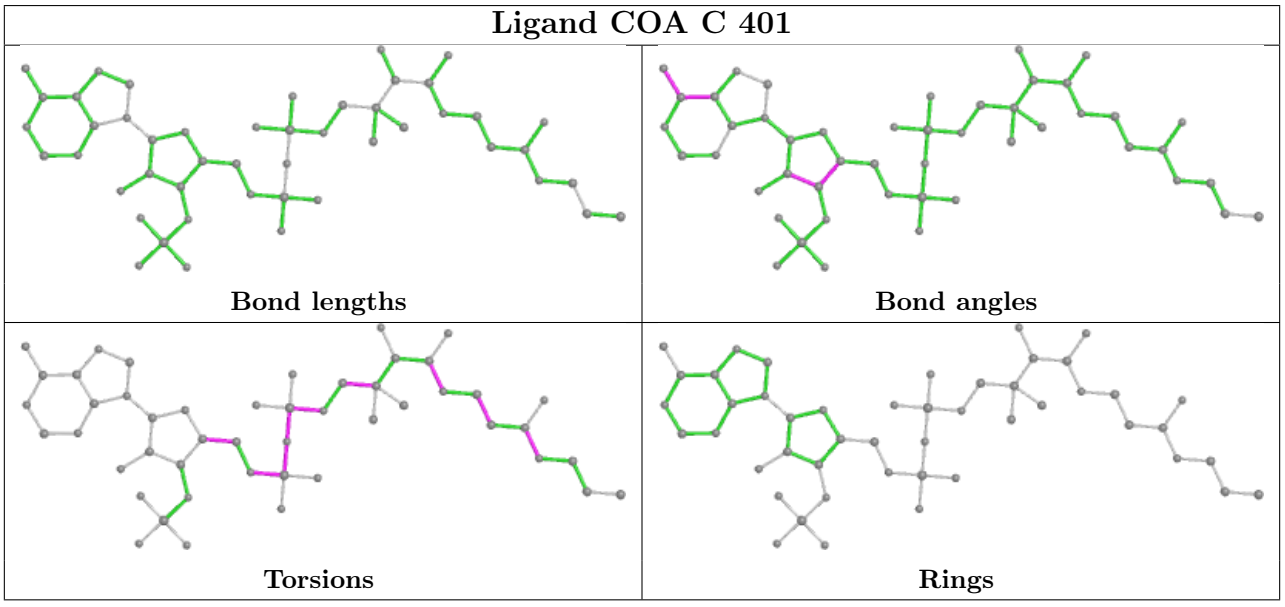
Ligand COA B 401 (A)



Ligand COA A 401



Ligand COA C 401



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	382/413 (92%)	-0.45	5 (1%)	74	73	18, 29, 49, 82	2 (0%)
1	B	382/413 (92%)	-0.41	2 (0%)	87	86	18, 30, 53, 86	0
1	C	382/413 (92%)	-0.36	2 (0%)	87	86	20, 33, 54, 91	0
1	D	382/413 (92%)	-0.44	1 (0%)	90	90	10, 30, 47, 88	4 (1%)
1	E	382/413 (92%)	-0.43	1 (0%)	90	90	18, 32, 48, 73	0
1	F	385/413 (93%)	-0.28	6 (1%)	70	69	15, 35, 53, 92	1 (0%)
All	All	2295/2478 (92%)	-0.39	17 (0%)	84	82	10, 31, 51, 92	7 (0%)

All (17) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	13	PRO	3.9
1	F	77	PHE	3.8
1	F	11	ALA	3.6
1	F	12	LEU	3.0
1	A	263[A]	HIS	2.6
1	F	396	SER	2.6
1	F	54	GLU	2.6
1	C	396	SER	2.5
1	D	396	SER	2.5
1	A	94	GLU	2.4
1	B	209	GLU	2.3
1	C	263	HIS	2.3
1	A	283	LYS	2.2
1	A	255	GLU	2.2
1	B	237	GLU	2.1
1	A	271[A]	PHE	2.1
1	E	396	SER	2.0

6.2 Non-standard residues in protein, DNA, RNA chains (i)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
1	CSD	F	170	8/9	0.94	0.09	31,32,34,36	0
1	CSD	B	170	8/9	0.96	0.07	28,33,36,42	0
1	CSD	C	170	8/9	0.96	0.07	30,33,36,40	0
1	CSD	A	170	8/9	0.96	0.08	27,33,38,54	0
1	CSD	E	170	8/9	0.97	0.07	27,30,37,40	0
1	CSD	D	170	8/9	0.98	0.06	27,32,34,35	0

6.3 Carbohydrates (i)

There are no oligosaccharides in this entry.

6.4 Ligands (i)

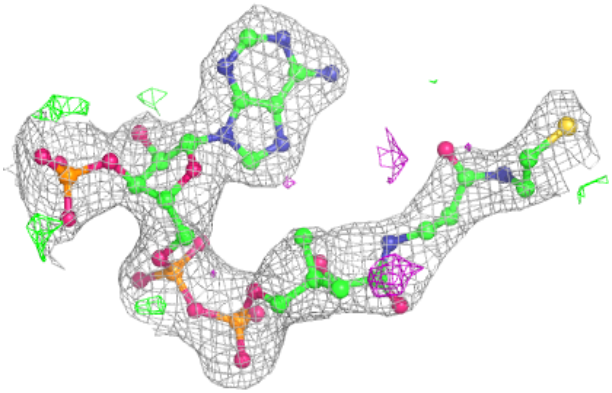
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

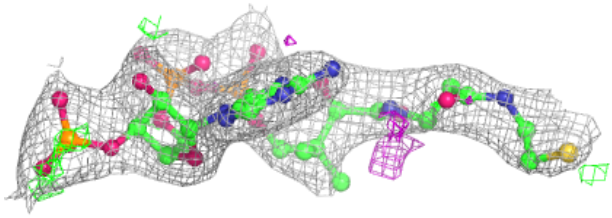
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	EDO	A	402	4/4	0.89	0.12	39,39,42,43	0
3	EDO	D	402	4/4	0.89	0.12	33,37,38,39	0
2	COA	B	401[A]	48/48	0.91	0.10	33,43,50,57	48
2	COA	B	401[B]	48/48	0.91	0.10	31,46,58,68	48
3	EDO	D	401	4/4	0.92	0.08	28,28,30,30	0
2	COA	C	401	48/48	0.92	0.10	38,47,60,76	0
3	EDO	F	401	4/4	0.92	0.09	29,31,33,33	0
2	COA	A	401	48/48	0.93	0.09	35,44,53,64	0

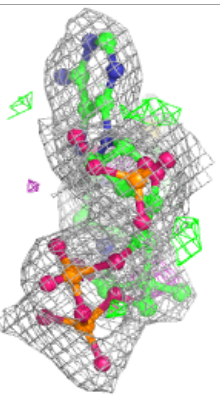
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around COA B 401 (A):

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

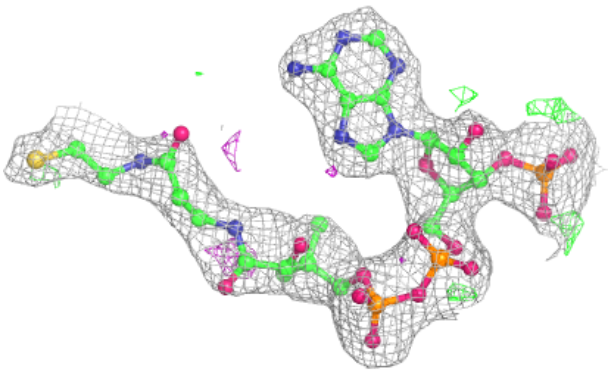


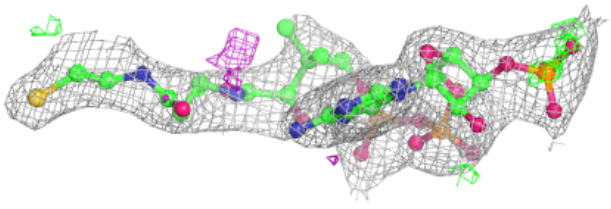


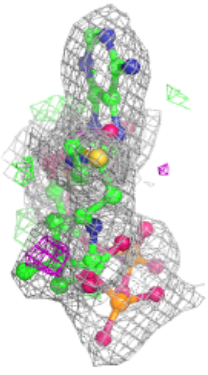


Electron density around COA B 401 (B):

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

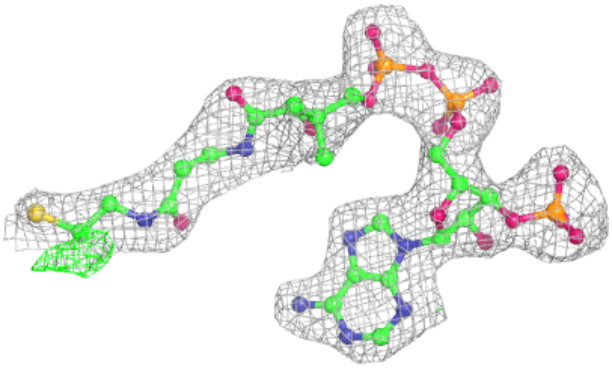


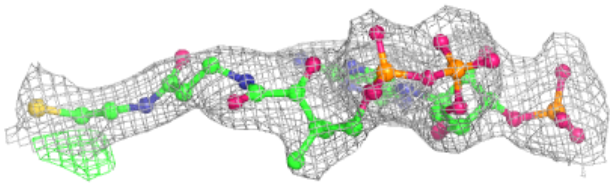


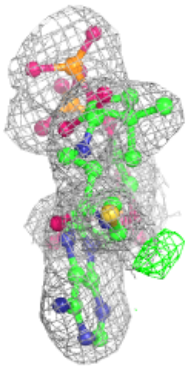


Electron density around COA C 401:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

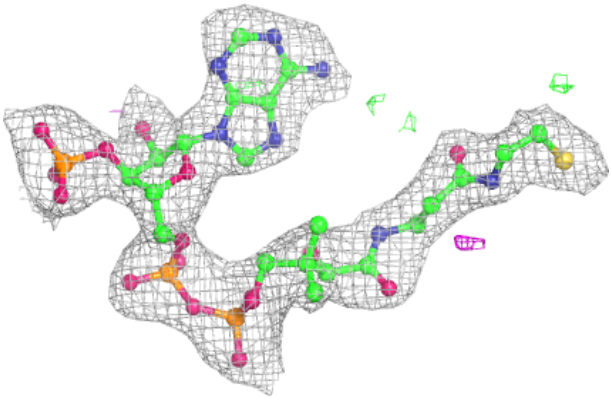


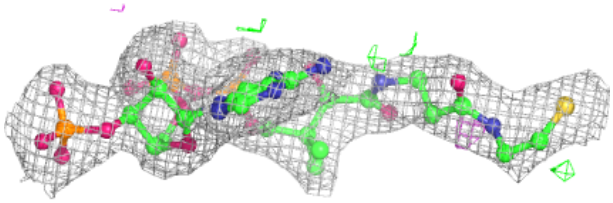


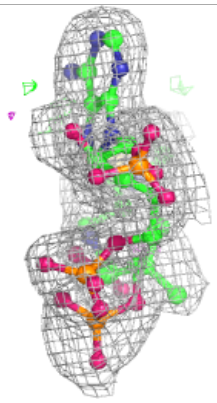


Electron density around COA A 401:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)







6.5 Other polymers (i)

There are no such residues in this entry.